

Stretch Appendix to the Building Energy Code in Massachusetts Frequently Asked Questions (FAQ) – July 1, 2011

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General Questions

1. Why did the Board of Building Regulations and Standards (BBRS) create this option?

MGL Chapter 169 requires that a municipality seeking to be a Green Community adopt an advanced energy conservation code for buildings. In order to meet the requirement of MGL c. 169, the BBRS, along with the state's energy and environmental agencies, collaborated with regional and national code experts to develop one 'stretch code' that is consistent across the state.

2. What are some of the expected benefits to a municipality of a more stringent energy code?

The stretch code allows municipalities to take meaningful action on energy use and climate change; it will likely yield cost savings for local residents and businesses, and will increase design and construction firm competitiveness in the growing green building marketplace.

3. What are the anticipated costs of the stretch code?

Construction costs are estimated to rise approximately \$3,000 for a typical single family home, and by 1% to 3% of total costs for commercial buildings. However, after energy cost savings on heating and electricity are included, these higher performance standards should* save money. In addition, the state's electric and gas utilities provide financial incentives that further reduce the upfront costs of high performance buildings.

*For example, a residential home purchased with a 30-year mortgage would typically result in net savings to the homeowner in the first year due to energy bill savings that are larger than the increase in mortgage payments from construction and financing costs. Case studies of commercial buildings utilizing the improvements on which the commercial code changes are based have shown paybacks of 1 to 2 years, when standard

incentives from electric utilities are included on the benefits side.

4. Where can I find and read more about the stretch code appendix?

The stretch code appendix language is freely available on the Massachusetts BBRS website,¹ along with a 2-page summary² of the code and other explanatory documents. In addition the stretch code appendix 780CMR 115.AA can be found with the rest of the Massachusetts energy code in the state bookstore. As the commercial stretch code in particular amends the base energy code, they are best read together. The base energy code is now the International Energy Conservation Code, 2009 edition (IECC 2009).

Scope

5. Does the stretch code apply to major renovation projects as well as new construction?

For commercial buildings: no. For residential buildings: yes. The stretch code has less stringent energy performance requirements for renovations than for new buildings. In addition, those doing additions and renovations have the option of using a simple "prescriptive" path to code compliance. The prescriptive path specifies a set of minimum energy efficiency requirements for different building materials and systems, instead of requiring energy performance modeling and testing. This flexibility is available due to the greater design constraints involved in working with an existing building. Due to the wide variety in types and conditions of commercial buildings, at this time there are no widely-accepted standards for renovating such buildings, so only new

¹ Stretch code language:

http://www.mass.gov/Eeops/docs/dps/8th_edition/115_appendices.pdf

² Stretch code 2-page summary:

http://www.mass.gov/Eeops/docs/dps/inf/stretch_code_overview_jun05_09.pdf

commercial buildings are covered by the stretch code requirements.

6. Does the stretch code apply to minor additions to existing buildings?

Additions to existing buildings that are large enough to require code compliance are treated in the same way as new construction for commercial buildings, and similarly to renovations in residential buildings. In both cases, those doing additions can follow the performance approach to code compliance or a simplified prescriptive path. For residential additions, the prescriptive path is very similar to the base energy code, but also requires the use of a checklist to ensure quality installation of insulation and air sealing, use of Energy Star windows, doors and skylights as appropriate, and tighter duct sealing for new heating and cooling systems.

7. What happens to buildings not covered by the stretch code?

Building types that do not fall under the stretch code scope, such as small commercial buildings under 5,000 sq. ft., will follow the existing base energy code requirements, which is the IECC 2009 with Massachusetts amendments which can be found at: www.mass.gov/dps

8. What categories do multi-family residential buildings fall into?

Residential multi-family buildings that are above 100,000 square feet and at least four stories tall have to follow the same performance path (20% better than the ASHRAE standard 90.1-2007) as other commercial buildings larger than 100,000 square feet. Residential buildings below 100,000 square feet and at least four stories tall are classified with commercial buildings between 5,000 and 100,000 square feet. Multi-family homes with one to three stories of any size fall under the residential stretch code standards. In the rare case of a multi-family building of three stories or less that is larger than 100,000 square feet, the developer may elect to be treated either as a residential or as a commercial building.

9. Does the stretch code apply to historic buildings?

Both the stretch code and the base energy code exempt historic buildings listed in state or national registers, or designated as a historic prop-

erty under local or state designation law or survey, or with an opinion or certification that the property is eligible to be listed.

Standards

10. What standards are the stretch code appendix based on?

The residential stretch code is based on the pre-existing "Energy Star for Homes"³ program developed by the federal EPA and Department of Energy, and customized for Massachusetts. This Energy Star program is in turn built upon the Home Energy Rating System (HERS) which is developed and administered by the national Residential Energy Services Network (RESNET).⁴

The Commercial stretch code for buildings from 5,000 to 100,000 square feet is based on the International Energy Conservation Code (IECC 2009), which is now the base energy code for Massachusetts, with further improvements derived from the New Buildings Institute (NBI) Core Performance program for commercial buildings (recently revised and published as the Core Energy Code).⁵ Above 100,000 square feet commercial buildings are required to show a percentage reduction below ASHRAE 90.1-2007 energy standards.⁶ This performance approach is also an option for smaller commercial buildings.

Enforcement/Requirements

11. What is the role of a building code official and a HERS rater for residential projects?

Residential buildings meeting the stretch code through a HERS rating and Energy Star Qualified Homes Thermal Bypass Checklist require independent certification by a HERS rater. The rater will produce a report detailing the energy systems in the building and will provide a HERS index score, together with proof of whether the home qualifies for any federal tax credits. Submission of the HERS report, together with a com-

³ The Massachusetts New Homes with Energy Star program website is: <http://www.energystarhomes.com/>

⁴ The RESNET website is: <http://www.natresnet.org/>

⁵ The Core energy code is available online at:

<http://www.newbuildings.org/codes.htm>

⁶ The ASHRAE 90.1-2007 standard is readable online in a Java enabled browser at:

http://openpub.realread.com/rrserver/browser?title=/ASHRAE_1/ashrae_90_1_2007_IP_1280

pleted Energy Star Qualified Homes Thermal Bypass Checklist, are the steps required to demonstrate compliance with the energy portions of the code and must be submitted to the local building inspector prior to receiving a certificate of occupancy. In this way, the local inspector retains their oversight role, but the additional energy requirements do not place a significant additional burden on their time.

12. When is duct leakage testing required on existing building projects?

The general guidance is that any new equipment and duct components, which are added to an existing HVAC system, should be leak tested.

However, this guidance may not be reasonable in certain projects; for example, small additions (under say 400 sq. ft.). In a case like this the cost of leak testing the new supply and return branch runs may be high relative to the cost of the HVAC project. Here the guidance is that if the leak testing exceeds 15% of the cost of the HVAC work then leak testing is not required (cost ratio to be submitted to the building official as part of the permit application). Additional guidance, in the absence of cost comparisons, is if the new supply and branch runs tie into existing trunks then leak testing is not required.

If as part of an HVAC system upgrade, a new furnace is installed, then it is reasonable to expect that the new furnace and new duct runs should be tested. This testing should be done prior to connecting the existing trunks, and supply and return branches to the new furnace.

Example A – Enclosing a small rear deck area: A small room that may require only two 7 inch branch runs would NOT require duct testing on the old system or the two new branch runs.

Example B – Finishing an area above a 3 car garage: An area of this size will typically require installing a small main supply, return duct trunk line and multiple branch duct runs. In this case the new work would need to be tested for leakage per the code guidelines.

Typically the easiest way to do this would be to test the new ductwork BEFORE it is tied to the original duct system of the dwelling and prior to

enclosure in soffits or sheetrock, which would block access for repairs.

13. Who may perform duct leakage testing?

There is no certification necessary to perform duct leakage testing.

Residential Building Questions

R1. How do I meet the residential stretch code for new homes?

For new residential homes including multi-family homes of 3 stories or less, builders essentially follow the 2006 Energy Star for Homes program requirements in Massachusetts, and must show that each unit meets or is below a maximum HERS index score. For new homes greater than 3,000 ft² in size the maximum HERS score is 65 (similar but not identical to Energy Star Tier 2), for smaller homes less than 3,000 ft² the maximum HERS score is 70. In addition, the homes must be inspected using the Energy Star Qualified Homes Thermal Bypass Checklist, and as with the new base energy code, it will likely require duct testing. These inspections ensure that the home is well air-sealed, while the HERS rating ensures that the home is designed to be well insulated with efficient heating, cooling and lighting – all measures that save energy and reduce utility bills. The IECC usually publishes new editions approximately every three years.

R2. Do I have to get a HERS rating?

New homes built under the stretch code must get a HERS rating. Renovations and additions to homes have the option of the HERS rating or a 'prescriptive' approach, whereby specific efficiency measures are required, but no computer modeling is done. The HERS performance-based approach provides an excellent way to ensure that homes are not only well designed, but also well built. As part of the HERS rating, the home will be tested for air leakage and under both the base and the stretch code homes with heating and cooling ducts may also have those tested for leakage. Combined with the Energy Star Qualified Homes Thermal Bypass Checklist, the HERS rater, builder, and building inspector can have confidence that the completed homes really are energy efficient.

R3. How do I meet the residential stretch code when making renovations to existing homes?

Existing homes being renovated or expanded have two choices when it comes to stretch code compliance. The performance option is based on a HERS rating, while the prescriptive option uses the base IECC 2009 energy code, and in addition, requires quality assurance with Energy Star Qualified Homes Thermal Bypass Checklist and the use of Energy Star 5.0 (Version 3) for windows, doors, and skylights where replacements are made. If the prescriptive option is chosen, then code must be met for the systems that are being replaced. This means that adding a new efficient boiler does not require changing the windows, and adding wall and attic insulation does not require modifying the basement – although it may often make sense to combine measures where doing so is cost-effective.

Choosing to follow the HERS rating approach used by new construction often makes sense when doing a whole house renovation. While using the same HERS approach as new homes, existing homes have an easier standard to meet. The maximum allowable HERS score is 80 for home renovations greater than 2,000 ft² and 85 for renovated homes less than 2,000 ft².

R4. If I'm doing a small remodeling project, like a kitchen or a bathroom renovation, will I have to meet the stretch energy code?

If a small renovation involved replacing a couple of windows and opening part of a wall cavity, then those new windows and wall cavity would have to be brought up to the stretch code, just as the plumbing in the kitchen or bathroom being remodeled would have to comply with the plumbing code. However, improving a kitchen or bathroom would not trigger required changes to the rest of the home, such as attic insulation or a new heating system. Only the systems being modified have to be brought up to code. Despite not being required, your contractor, utility company, and code official may suggest cost-effective changes (often with tax and rebate incentives to reduce your energy bills) that you may want to consider doing at the same time.

R5. What training and certification do HERS raters undergo?

HERS raters are typically experienced building professionals, who in addition take a week or two week-long intensive training course in residential energy efficiency. After completing the training, learning how to use HERS rating software, and passing a test,⁷ new raters must also complete at least 5 ratings with an experienced HERS rater before being able to independently award ratings. In addition to this initial training and certification, HERS raters must be affiliated with a company that is certified as a HERS provider, and is responsible for ongoing code education and quality assurance oversight of the HERS rater's work. The HERS providers also carry liability insurance and allow builders to request a review from a second HERS rater in the rare case of disputes.

R6. What testing equipment is required to meet the residential stretch code?

HERS ratings require testing of the air leakage rate of residential units. In addition, for homes that have forced air heating and central air conditioning systems that have ductwork running outside of the heated portion of a house, a duct leakage test is needed. These tests help calculate how much energy is needed to heat and cool a home and help builders to identify possible problems before a home is completed, when there is still time to fix them cost-effectively.

R7. Are there enough HERS raters and testing equipment available, and what do they cost?

In 2008 over 15% of all new homes in Massachusetts were built through the Energy Star for Homes program. In 2009, that climbed to 34% without any noticeable shortages. The majority of these homes used HERS raters and testing equipment to achieve a HERS rating. The growing interest in HERS ratings has led to more building professionals going through HERS training and certification and expanded sales of blower door and duct testing equipment. The Massachusetts Energy Star Homes website now lists several new HERS provider companies,⁸ and many more builders as Energy Star Homes partners. There is already in place an active market for HERS raters and testing equipment, and we don't anticipate demand for HERS raters exceeding the supply.

⁷ More information on the HERS rater test is available here:

<http://www.resnet.us/rater/tests/rater.htm>

⁸http://www.energystar.gov/index.cfm?fuseaction=new_homes_partners.showStateResults&s_code=MA

Costs for HERS ratings currently range from around \$600 to \$1,500 per unit in Massachusetts, and they are also subsidized by the utility-sponsored Energy Star for Homes program. The price variation may reflect differing levels of technical assistance to the builder depending on their needs and preferences.

R8. How much more does it cost to build to the stretch code, and how does this compare to the energy savings?

Data has shown that for new construction, additional first costs are estimated at around \$3,000 for a 2,700 square foot single-family home, including the cost of a HERS rater. This is reduced to about \$1,700 after receipt of \$1,300 in utility rebates, which translates into around \$125 a year when rolled into a 30-year mortgage at 6% interest. But these investments reduce energy bills by about \$500/year, resulting in a potential net annual savings to the homeowner of about \$400. For a larger 4,400 square foot home, the additional costs are higher but so are the energy savings, resulting in a net annual savings of \$1,100.

In the case of renovating a 3-unit urban triple-decker, the minimum additional construction costs for all three units combined relative to meeting the new base energy code is only around \$1,400, while the annual energy savings are over \$130 per year, yielding small but immediate net cash savings to the unit owners. Larger annual savings could be achieved by more aggressive energy efficiency improvements, but the stretch code requirements for renovations are modest.⁹

R9. What financial savings/rebates are there from building to the stretch code?

The stretch code is designed to allow builders to maximize use of the Energy Star Homes program with its full range of training, support and financial incentives. A new home with a HERS rating of 65 or less currently qualifies for \$1,250 from the Energy Star utility sponsors, and additional rebates are available for installing high efficiency

heating and cooling equipment, appliances and lighting. The utility companies also provide \$650 to partially or fully cover the cost of hiring a HERS rater to work with the builder.

For existing home renovations there are tax credits for the homeowner as well as the same utility incentives on efficient equipment, appliances, and windows. There are also major incentives available to add insulation and reduce air leakage in existing homes, through the MassSave program sponsored by the gas and electric utility companies.¹⁰

R10. How is the MA stretch code different from the existing Energy Star for Homes program?

The Energy Star for Homes program is a voluntary program for home builders. In Massachusetts it is currently administered by ICF International on behalf of the major electric utilities in the state, and has over two hundred builders enrolled.¹¹ The program accounted for 15% of all new homes in Massachusetts in 2008 and 34% in 2009. There are currently 3 tiers to the Energy Star program. The stretch code essentially makes the 2006-2010 Energy Star program requirements mandatory in any adopting municipality, and sets a specific minimum HERS index rating of 65 or 70 based on size for new homes, and less strict requirements for renovations.

R11. Do I have to use the Energy Star program?

The Energy Star Homes program is strongly recommended, but not required. It is also going through a transition from Energy Star v2.0 to Energy Star v2.5 and ultimately v3.0. Residential builders in stretch code communities will be required to get a HERS rating for new homes and the utility funded programs can help offset the cost of this rating. In the case of renovation or additions to existing buildings builders may instead utilize the prescriptive option – using only Energy Star qualified new windows, doors and skylights and carefully sealing ducts that are outside the heated space if installing new heating systems. In both cases builders must also complete the Energy Star Qualified Homes Thermal Bypass Checklist. In order to simplify qualifica-

⁹ Separate documents are available that summarize the detailed cost-benefit analysis that has been undertaken to help set the appropriate level of energy efficiency for the stretch code. These calculations do not include substantial financial incentives available both from utilities in Massachusetts and through federal tax credits (see next question).

¹⁰ <http://www.masssave.com/residential/>

¹¹ http://www.energystar.gov/index.cfm?fuseaction=new_homes_partners.showAreaResults&s_code=MA&msa_id=all

tion for the rebates, training and technical assistance that are offered we recommend that builders participate in the Energy Star Homes program, but it is not mandatory.

R12. How does the building official in my town/city check whether I met the stretch energy code?

For several years, under both the 7th edition and the 8th edition base energy code in Massachusetts it has been possible to show code compliance by achieving a HERS rating and/or Energy Star Homes certification, and submitting a copy of the HERS report and Energy Star paperwork to the local building code official to demonstrate this. The stretch code expands the use of this existing code compliance option to all residential construction.

R13. How does the stretch code work with LEED for Homes?

LEED for Homes is a voluntary residential green building program that includes a significant energy efficiency component. The mandatory energy and atmosphere requirements of the LEED for Homes program are the minimum Energy Star Home requirements of a HERS 85 rating and a completed Energy Star Qualified Homes Thermal Bypass Checklist. Homes can then gain additional points for achieving a lower HERS score. Because LEED for Homes and the stretch code share the same HERS and Energy Star underpinnings they are fully compatible.

R14. When following the prescriptive path for residential additions or renovations can the builder or architect complete the thermal bypass checklist?

Yes. They do have to sign to say that the relevant measures were checked in the field. A HERS rater is needed only if a HERS rating is needed or to go through the Energy Star Homes program (primarily for new construction and gut retrofits).

R15. The energy conservation code requires that a certificate which indicates R-values, HVAC equipment, etc. be posted. Is there a form available for this?

Yes. The following form, created by building officials, is provided as a sample that meets this requirement: [Residential Energy Compliance Certificate](#).

Commercial Building Questions

C1. What building types are covered by the commercial stretch code?

New buildings, and new additions to existing buildings covered by the commercial energy code, that are greater than 5,000 ft² in size are covered by the stretch code appendix. New commercial buildings smaller than 5,000 square feet, as well as renovation to existing commercial buildings, are exempt from the stretch code and remain covered by the base energy code.

C2. What is required for large new commercial buildings above 100,000 square feet?

The designed energy use in large commercial buildings is required to be at least 20% below the use expected based on the energy modeling standards contained in ASHRAE 90.1 2007,¹² which is the latest version of the national model code for commercial buildings. This is determined by computer modeling of the building energy use, taking into account factors such as air sealing, insulation, efficiency of the cooling and heating systems, and lighting design. Builders have the flexibility to choose the set of energy efficiency features they prefer, as long as modeling shows that overall these features yield the required 20% reduction relative to the base ASHRAE 90.1-2007.

C3. What is required for new commercial buildings between 5,000 and 100,000 square feet?

Builders of such buildings have two choices. First, they can use the same modeling approach as buildings larger than 100,000 ft², and show that the expected energy use is at least 20% below the code requirements of ASHRAE 90.1 2007. Alternatively, they can choose a set of "prescriptive" requirements for particular efficiency measures, based on the new base energy code for commercial buildings (IECC 2009 Ch.5), supplemented by enhancements taken from the Core Energy Code developed by the New Buildings Institute (NBI).¹³ The Core Energy Code and its precursor the Core Performance Guide are nationally-recognized standards already in use by Massachusetts gas

¹² Specifically: ASHRAE Standard 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings, Appendix G.

¹³ For more information please see the New Buildings Institute press release available here: <http://www.newbuildings.org/downloads/press/MAAdoptsStretchCode.pdf>

and electric utilities as the basis for providing financial incentives to commercial building developers.

C4. What is required of small new commercial buildings, below 5,000 square feet?

Such buildings are exempt from the Stretch Code requirements.

C5. How are commercial renovations handled by the stretch code?

Commercial renovations are exempt from the Stretch Code requirements.

C6. How are new commercial buildings with special energy needs handled?

Supermarkets, laboratories, and warehouses **above 40,000** ft² must meet the performance modeling requirements of the stretch code that apply to regular commercial buildings greater than 100,000 square feet. Because these buildings often have large and unusual energy loads developers are likely to model their energy usage as a standard design practice, so meeting the standard of 20% below ASHRAE 90.1-2007 via energy modeling should not require a new compliance approach.

Supermarkets, laboratories, and warehouses **below 40,000** ft² are exempt from the stretch code requirements, but must still meet the base energy code. Other specialty buildings can apply to the Mass. BBRS for waivers based on evidence that they have unusual energy loads, and that they are not typically built using energy modeling.

C7. How do the benefits and costs from the commercial stretch code standards compare to the baseline code?

Case studies of specific buildings by Massachusetts utility companies National Grid and NSTAR show that the savings in reduced energy costs far exceed the greater initial construction costs. If the costs are included in a mortgage, then owners would see immediate cash-flow savings. Moreover, the utilities offer generous incentives that make the efficiency improvements even more profitable. For example, on one mid-sized office building in Leominster, Mass, the additional cost was \$101,000, while the annual energy savings were \$27,600, for a four year payback. But the utility energy efficiency program provided a re-

bate of \$66,600, reducing the initial cost to \$34,000. As a result, the energy savings pay for the extra costs in just over one year. More generally, we anticipate that any additional upfront costs incurred in construction should be recovered from energy savings with a payback after rebates of less than three years.

C8. How does the stretch code work with LEED buildings?

The commercial stretch code has two code compliance pathways. Both of these qualify for LEED new construction points, and require no additional work because of the stretch code. If pursuing the performance approach, then achieving the stretch code standard of 20% below ASHRAE 90.1-2007 uses the same baseline and modeling as the 2009 LEED program and qualifies for 5 out of 19 LEED energy and atmosphere points. Many LEED buildings will go significantly beyond these energy efficiency requirements, in order to obtain additional LEED points. Similarly, meeting the stretch code through the Core Performance-based prescriptive approach qualifies for LEED points.

C9. Does the stretch code require 3% renewable electricity or solar panels?

No – one of three possible options may be chosen under Section 507 of the prescriptive path of the stretch code to meet one of the requirements of the code. One of those three options includes on-site renewable electricity generation. Builders may also choose to meet the commercial stretch code requirements using the 20% better than ASHRAE 90.1-2007 modeling approach. The three options for buildings between 5,000 and 100,000 square feet are:

- a) More efficient heating and cooling equipment – widely available and with utility rebates that offset much of the incremental cost.
- b) More efficient lighting – also widely available and eligible for significant utility rebates.
- c) Providing at least 3% of the on-site electric load from on-site renewable generation – which qualifies for both large federal tax incentives and significant state renewable energy incentives administered by the Department of Energy Re-

sources¹⁴ and the Massachusetts Clean Energy Center¹⁵ (MA CEC).

¹⁴http://www.mass.gov/?pageID=eoeeterminal&L=5&L0=Home&L1=Energy%2c+Utilities+%26+Clean+Technologies&L2=Renewable+Energy&L3=Solar&L4=RPS+Solar+Carve-Out&sid=Eoeea&b=terminalcontent&f=doer_renewables_solar_about-the-rps&csid=Eoeea

¹⁵ <http://www.masscec.com/index.cfm?pid=11159>